

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Collaborators: \_\_\_\_\_

(Collaborators submit their individually written assignments together)

Question:	1	2	3	4	5	6	Total
Points:	10	5	10	20	15	10	70
Score:							

Instructor/grader comments:

**Vector and matrix norms**

1. Find  $l_2$  and  $l_\infty$  norms of the vectors.

(a) (5 points)  $x = (5, -12, 0)^t$

(b) (5 points)  $x = (1, -2, 2)^t$

2. (5 points) Find  $l_\infty$  norms of the matrix.

$$\begin{bmatrix} 2 & -5 & 0 & 0 & 0 & 0 & 0 & 3 \\ 0 & -5 & 3 & 2 & 4 & 0 & 0 & 0 \\ 0 & 0 & 0 & -2 & 0 & 2 & 1 & 0 \\ 1 & -1 & -7 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 1 & 0 & 0 & -1 \\ 0 & 0 & 1 & -1 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & -1 & 0 \\ 0 & 0 & 0 & 3 & -1 & 0 & 1 & 0 \end{bmatrix}$$

3. (10 points) Find  $l_2$  and  $l_\infty$  norm of the identity  $n \times n$  matrix.

**Eigenvalues and eigenvectors**

4. Compute the eigenvalues and associated eigenvectors of the following matrices. Find the spectral radius for each matrix.

(a) (10 points)

$$\begin{bmatrix} 2 & -1 \\ -1 & 2 \end{bmatrix}$$

(b) (10 points)

$$\begin{bmatrix} 2 & 1 & 0 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

**Jacobi, Gauss-Seidel, and SOR methods**

5. (15 points) Use the code that we develop in class and conduct numerical experiments to compare the performance of the Jacobi, Gauss-Seidel, and SQR methods.

Try several values of  $\omega$  and present your results for the best performing value.

On the same graph plot the convergence parameter vs the iteration for the three methods, using  $A = \text{laplace2d}(n)$  and  $b = \text{ones}(n^2, 1)$  for  $n = 16$ . Clearly describe your conclusions in your project's readme file. Place the code you wrote for this part of the homework in the matlab file **hw03p5.m**

**Gitlab**

6. (10 points) Create a gitlab project called **hw03** (name it exactly as shown). Upload **all** files that are required to run your matlab code and create your README.md file. Share the project with the instructor and the grader.